

A CLEAN AND GREEN FLEET

An Updated Action Plan
For the City of Seattle



August 2014

Prepared by:

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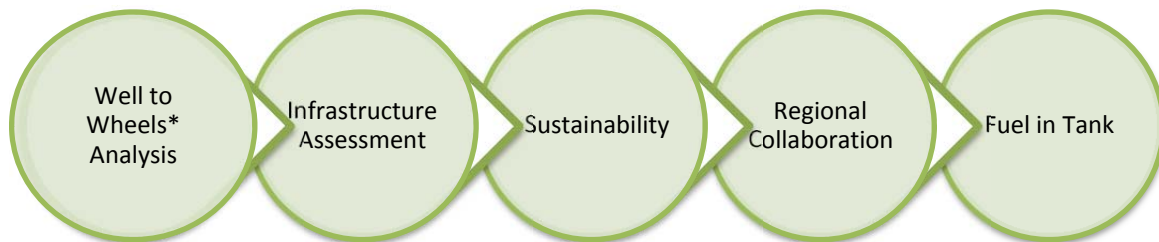
- Regional Response Collaboration – The City will partner with external stakeholders to advance the overall strategic EV infrastructure agenda.

Target: Install infrastructure for 300+ EVs in fleet facilities by 2020.

Action 3. Expand Biofuel Use

While biofuels are a “greener” option over petroleum, not all biofuels are created equal. For instance, some may have a higher carbon footprint than others and some may compete with our nation’s food supply. A challenge of evaluating the viability of biofuels is balancing sustainability, environmental impact and land use implications. FAS has developed a decision pathway to facilitate informed decisions when purchasing biofuels. The pathway will consider life cycle energy costs, available infrastructure, sustainability parameters and opportunities to form a regional “buying consortium.” The goal of this process is to decrease costs, increase choices and make sustainable environmental business decisions when purchasing biofuels.

Biofuel Decision Pathway



**Well to Wheels: cradle-to-grave analysis of total energy consumption of the specific fuel. GREET Model (Argonne National Laboratory) can be used for this.*

Target: Solicit a Request for Proposal for biodiesel in 2014 to purchase only sustainable, locally sourced biofuel for all B20 blends of biodiesel.

Action 4. Improve Department Operational Efficiency

FAS’ role in the City’s green fleet efforts includes vehicle procurement, fueling infrastructure management and development, in-vehicle technology installation and working with the auto industry to stimulate markets for preferred vehicles. However, the biggest gains toward fuel reduction can be made by City departments assessing their service delivery and identifying opportunities to reduce fuel by changing the way service is delivered. It is ultimately up to the departments to determine and plan how best to increase operational efficiency to reduce fuel consumption. Under this initiative, each City department is strongly encouraged to prepare a Fuel Reduction Opportunities Assessment and Implementation Plan (FROAIP). FROAIPs address five distinct areas:

1. Management Support – including a statement about management’s commitment to reduce fuel through improved delivery of City services. This section should also describe how middle and field management will be held accountable to outcomes.
2. Service Delivery Assessment – includes a thorough assessment of how departmental services are delivered.
3. Fuel Reduction Opportunities – includes a list of opportunities to reduce fuel through procedural or process changes in service delivery.
4. Steps for Implementation – outlines actionable items to implement the fuel reduction opportunities, evaluation measures and a timeline for implementation.
5. Progress Reporting and Continual Improvement – will include the department’s self-determined benchmarks and identification of a system to integrate new opportunities that are revealed during FROAIP implementation.

FAS’s Green Fleet Coordinator is available to assist departments in developing robust FROAIPs by facilitating discussions and providing industry expertise to develop a road map for changes in service delivery to increase fuel efficiency.

Target: FAS will submit fleet GHG reduction reports every year to assist departments to benchmark progress and evaluate effectiveness of fuel reduction initiatives.

Action 5. Champion Fuel Reduction Initiatives

The best way to reduce GHG emissions is to reduce petroleum fuel use overall. FAS will support this effort in several ways:

- Increase Biofuel Usage – FAS will issue a Request for Proposals (RFP) for biodiesel fuel procurement. This solicitation will be for a locally-sourced, waste-derived vegetable biodiesel B20 blend. B20 will be used in all current diesel fuel sites by late 2014/early 2015.
- Citywide Anti-Idling Policy – FAS will implement an appropriate policy instrument for a standard Citywide anti-idling policy.
- Expand In-Vehicle Technology – FAS will research and deploy new technology to reduce fuel consumption as it becomes available. Some examples include:
 - *IdleRight system in all Seattle Police Department Patrol Cars* – Idle management systems, which allow patrol officers to turn off their patrol cars when idle while maintaining power for necessary computer equipment. IdleRight will be installed in all new patrol vehicles as of Jan. 1, 2014.

- *Advanced Vehicle Locator Systems* – Advanced Vehicle Locator (AVL) systems are GPS-enabled locator devices that monitor and correct excessive idling or speeding. This improves maintenance and overall driver performance. An AVL pilot study will begin on a select group of vehicles by the end of 2014.
- Tracking Progress – A 42 percent GHG reduction plan over seven years equates to a 6 percent overall GHG reduction each year. This annual reduction target will be tracked and progress will be communicated to departments each year. FAS will provide annual GHG “report cards” to all City departments outlining GHG, vehicle miles traveled and fuel use by department.

Target: Reduce fossil fuel consumption by 1 million gallons annually by 2020 (using 2013 as a baseline year).

Action 6. Push Vehicle Market Development

Alternative vehicle choices have expanded significantly in recent years. However, choices are still limited or non-existent in some high-impact areas. The City will push the market by generating demand for these vehicles.

- Police Patrol Cars – Currently no alternative fuel choices are available for this class of vehicle. Patrol cars are a *huge* source of fuel consumption for any municipality. In 2012, the Seattle Police Department’s 300 patrol cars used more than 500,000 gallons of fuel, which accounted for more than 20 percent of fossil fuels burned for the entire City fleet, including both Seattle City Light and Seattle Public Utilities. Any gains that can be made in the area of fuel reduction will pay off handsomely in terms of saving money, reducing environmental impact and attaining GHG reduction goals.

Target: Work with manufacturers to develop an EV or hybrid patrol car to be market ready by 2020.

- Light and Heavy-Duty Trucks – These are two high-impact vehicle classes where alternative technology can realize significant fuel savings. Currently, there are several manufacturers introducing EV and other alternative fuel options for both light and heavy trucks. The City will explore new technologies as they come online and purchase vehicles that align with our customers’ business needs.

Target: Expand alternative fuel truck fleet 15 percent by 2017.

- Hydrogen Fuel Cell Technology – The hydrogen market is expanding rapidly. Today, hydrogen fueling infrastructure is costly and geographically limited, but manufacturers are working to expand availability and affordability of hydrogen throughout the country. FAS will explore this new technology for potential use at the City. If regional market pressure can be applied by increasing fuel cell vehicle demand, the private market could be encouraged to develop fuel infrastructure in the Pacific Northwest.

Target: Purchase or lease up to five hydrogen vehicles by 2020 (pending available infrastructure).

7. Tell Our Story: Being Green, Saving Money, Advancing Technology and Blazing the Trail

As an early adopter of green fleet technology, the City is now in a unique position to draw from its decade of experience and data collection to share key impacts of these vehicles in fleet applications. We are a leader in this field and others are looking to us for guidance and information. By sharing our story, we can spur other green fleet initiatives and bolster the viability of the green vehicle market overall. This ultimately serves our interest in reducing GHGs by expanding the market, pushing new technology, increasing competition, driving costs down and increasing vehicle choices. Maintaining a high profile in the local, regional and national fleet communities will help other entities follow suit and garner wide support to keep the green fleet efforts moving forward at the City and beyond. We will focus on four communication channels in this action item, as illustrated in the figure below.



1. Media Press Releases – FAS will work with City public information officers and local media outlets to periodically release green fleet “success stories.” This will increase public awareness of the advancements the City is making in this area, how these efforts have saved taxpayer money in fuel costs, reduced GHG emissions and improved public health by burning less fossil fuel.
2. Publish Trade Articles – Publish articles in fleet trade magazines to highlight our experience with green fleet initiatives and share our experiences and “best practices” with other entities on a national scale.
3. Conference Presentations – Present green fleet data at select conferences to feature costs and benefits of going green and to foster broad networking opportunities.
4. Partnership Collaborations – Continue collaborating with existing partners such as the Puget Sound Clean Air Agency and form new partnerships with other agencies or organizations to share information, network and collaborate on alternative vehicle projects that are mutually beneficial.

**Target: 1) Publish one trade article per year.
2) Present at one local and one national conference per year.
3) Participate in one collaborative project with an outside agency per year.**

Target Summary Table

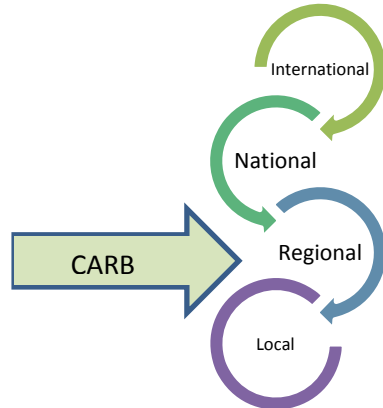
Action	Working Target	Hard Target
Reduce Greenhouse Gas (GHG) Emissions	6% annual reduction of GHG every year starting in 2014.	42% reduction in GHG by 2020.
Create Green Vehicle Selection Standard	Chose a green vehicle standard for each of the 10 major vehicle classes. Re-evaluate standards every 6-8 months based on market and technology advancements.	50% of new vehicles will be chosen from green vehicle standard.
Install Electric Vehicle Infrastructure	Conduct FAS-funded pilot study in 2014 to identify installation costs of EV charging stations.	Install 300+ charging stations in fleet facilities by 2020.
	Develop Electric Vehicle Supply Equipment (EVSE) master plan including a building electrical capacity assessment and identifying roles and responsibilities related to purchasing, installing, maintaining and replacing EV charging stations.	
	Explore grant funding to support EV infrastructure.	
	Collaborate with external stakeholders in a regional response to EV infrastructure challenges.	
Expand Biofuel Use	Procure high-quality, waste-derived (used cooking oil), locally sourced biodiesel to replace standard diesel in all City fuel sites.	Solicit RFP in 2014 to purchase B20 for all diesel fuel tanks by early 2015.
Improve Department Operational Efficiency	Departments are encouraged to assess their service delivery and identify opportunities that will reduce fuel by changing the way that service is delivered. FAS' Green Fleet Coordinator is available for assistance.	FAS will submit annual fleet GHG reduction reports to help departments evaluate progress.
Champion Fuel Reduction Initiatives	Increase biofuel usage by issuing an RFP for local-waste-derived biodiesel B20 blend and using B20 in all current diesel fuel tanks by the end of 2014.	Reduce fossil fuel consumption by 1 million gallons annually by 2020 (using 2013 as a baseline).
	Implement policy instrument for Citywide anti-idling policy.	
	Expand in-vehicle technology to reduce fuel consumption, such as install the IdleRight system in all SPD patrol cars, and a start an Advanced Vehicle Locator (AVL) pilot study on select vehicles in 2014.	
	Issue GHG report cards to each department on a yearly basis benchmarking progress against 6% annual reduction target.	
Push Vehicle Market Development	Apply market pressure to develop pursuit-rated EV or hybrid police patrol car.	EV or hybrid patrol car market ready by 2020.
	Explore new fuel technology for light and heavy-duty trucks and purchase vehicles that fit our business needs.	Expand alternative truck fleet 15% by 2017.
	Create regional market demand for hydrogen vehicles to ease fuel infrastructure costs.	Purchase up to five hydrogen vehicles by 2020 (pending available infrastructure).
Tell Our Story	Help decrease vehicle cost and increase alternative choices by expanding market through raising awareness of viability/affordability of alternative fuel vehicles. Share our 10+ years of data and experience operating one of the largest green fleets in the nation to help other agencies go green and create more demand in the market. Information share through press releases, magazine/journal articles, presenting at local conference and partnering with other agencies on alternative vehicle projects.	Publish one trade article, present at two conferences and participate in one collaborative project with outside agency at a minimum every year.

Appendix A – GHG Methodology & Baseline Inventory

Methodology

$$\text{GHG}_{\text{Fuels}} + \text{GHG}_{\text{Electricity (EVs)}} = \text{GHG}_{\text{Total}}$$

FUEL Inventory Reporting Standard:



A **regional** reporting standard set forth by the **California Air Resources Board (ARB)** Low Carbon Fuel Standards (LCFS)^{1,2} will be used to inventory the City’s greenhouse gas (GHG) emissions based on 2013 fuel consumption³. International and National standards are too broad in scope and provide emissions factors (EFs) with carbon intensities that are not consistent with our regional fuel types and pathways. While local standards may provide the most accurate EFs, at this time there is only one study[±] available from Washington state specifically discussing local carbon intensity EFs. While the Washington state study may provide the most applicable localized factors for select fuels, these EFs are not widely published or used and would provide data that is not comparable to other local and regional inventories. Because Washington carbon intensity for fuels is very similar to California, ARB EFs will be used to provide the most accurate, reproducible inventory.

The combustion of fossil fuels in mobile sources emits CO₂, CH₄ and N₂O. As such, all three gasses have already been converted to CO₂ equivalents² (CO₂e) and included in this inventory.

GHG emissions for fuels: CO₂e

$$\text{CO}_2\text{e emissions} = \text{Carbon Intensity Value}^2 \times \text{Fuel Energy Content}^4 \times \text{Fuel consumed}^3$$

Example calculation:

Carbon Intensity for diesel = 94.71 gCO₂e/MJ

Fuel Energy Content diesel = 135.5 MJ/gal

Diesel fuel consumed in 2012 = 1,060,914 gal

$$\text{Diesel CO}_2\text{e} = 94.71 \text{ gCO}_2\text{e/MJ} \times 135.5 \text{ MJ/gal} \times 1,060,914 \text{ gal} \times 1 \text{ kg}/1000\text{g} = 13,614,927 \text{ kgCO}_2\text{e}$$

Electricity Inventory Reporting Standard:



A **local** reporting standard based on **Seattle City Light** (SCL) 2012 retail power emission factor⁶ will be used to calculate GHG emissions for electric vehicle (EV) use. This EF was chosen because approximately 94 percent of electricity generated by SCL is from hydroelectric dams which produces a significantly *lower* emissions factor than typical utilities. It should be noted that SCL EFs are in units of CO₂ (not CO₂e). Also, electricity use for *each* EV is not available. However, the 26 Nissan Leafs in the motor pool are separately metered and chargers are exclusive to the motor pool Leafs only. As such, the aggregate kWh use and aggregate mileage for all 26 motor pool Leafs will be calculated (kWh/mile) and extrapolated to all Leafs operating outside the motor pool based on individual vehicle mileage.

GHG emissions for electricity: CO₂

$$\text{CO}_2 \text{ emissions} = \text{Emission Factor}^6 \times \text{unit conversions}^4 \times \text{kWh consumed}^5$$

Example calculation:

SCL Emissions Factor for 2011 Retail Power = 13.77 lbs CO₂/MWh

Energy and mass unit conversions = 1kg = 2.205 lbs; 1MWh = 1000 kWh

kWh consumed (2012 motor pool only) = 56,384 kWh

$$\text{Electricity CO}_2 = 13.77 \text{ lbs CO}_2/\text{MWh} \times 1\text{kg}/2.205\text{lbs} \times 1\text{MWh}/1000\text{kWh} \times 56,384 \text{ kWh} = 352.1 \text{ kgCO}_2$$

¹ CARB GHG Reporting regulations: <http://www.arb.ca.gov/cc/reporting/ghg-rep/regulation/mrr-2012-clean.pdf>

² CARB Low Carbon Fuel Standard (LCFS) Intensity Lookup Table 6 http://www.arb.ca.gov/fuels/lcfs/010611lcfs_lutables.pdf

³ City of Seattle Fleet Management Division (FMD) 2013 fuel consumption data – available upon request

⁴ MIT Energy Club Units & Conversions Fact Sheet <http://www.mitenergyclub.org/content/energy-fact-sheets>

⁵ City of Seattle FMD annual kWh consumption for motor pool Nissan Leafs – available upon request

⁶ SCL 2012 Retail Power Emission Factor <http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/#jump1>

[±] TIAX A Low Carbon Fuel Standard in Washington: Informing the Decision

Baseline Year & Metrics

2013 was selected as the baseline year from which all subsequent benchmarks will be measured. Baseline and annual inventories will quantify emissions as a function of the following metrics:

- Fuel consumption
- Number of vehicles
- Vehicle miles traveled (VMTs)
- Labor hours – as a proxy for productivity[‡]

2013 Baseline Inventory

GHG Fuel					
Fuel Type	2013 Gallons	Carbon Intensity* (gCO ₂ e/MJ)	Energy Content** (MJ/gal)	kgCO ₂ e	tCO ₂ e
Biodiesel B20 ¹	6,368.9	15.84	124.8	12,590.2	12.6
CNG ²	483.4	68.00	121.3	3,987.1	4.0
Diesel ³	1,119,300.8	94.71	135.5	14,364,216.5	14,364.2
Propane ⁴	4,206.8	83.13	88.1	30,809.6	30.8
Unleaded Gas ⁵	1,247,197.1	93.21	121.3	14,101,881.1	14,101.9
TOTAL	2,377,557.0	-	-	28,513,484.5	28,513.5

GHG Electricity			
Fuel Type	2013 kWh	SCL EF*** (kgCO ₂ /kWh)	tCO ₂
Electricity ⁶	89,260.3	0.01162	1.04

2013 Fleet GHG Emissions			
Fuel	28,513.48	tCO ₂ e	
Electricity	1.04	tCO ₂	
TOTAL	28,514.52	Metric tons of CO₂	

[‡]Productivity Metric - For the purpose of this plan, productivity will be measured in terms of labor hours worked at the City over any given year. This includes straight time, overtime and out-of-class time obtained by the City Personnel Department (earning codes: AA, AB, AC, CA, CB, CC, TA, TB, TC, GA, G, GC and EA, EB, EC if applicable). This metric is included to allow future inventories to be reported as a function of City productivity and normalized for increases or decreases in workload or levels of service delivery (and ultimately the need for more or fewer vehicles and more or less fuel as a result of that fluctuation).

*Carbon Intensity Values obtained from California Air Resources Board (CARB) Low Carbon Fuel Standard (LCFS) Carbon Intensity Lookup Tables. http://www.arb.ca.gov/fuels/lcfs/010611lcfs_lutables.pdf

References below cite pathway identifier number and analysis notes

¹BIOD002

²CNG002 (Sold as gallons of gas equivalent – GGE – therefore gasoline energy content was used)

³ULSD001

⁴LNG001 (LNG used in the absence of published LPG factor – difference assumed to be <10%)

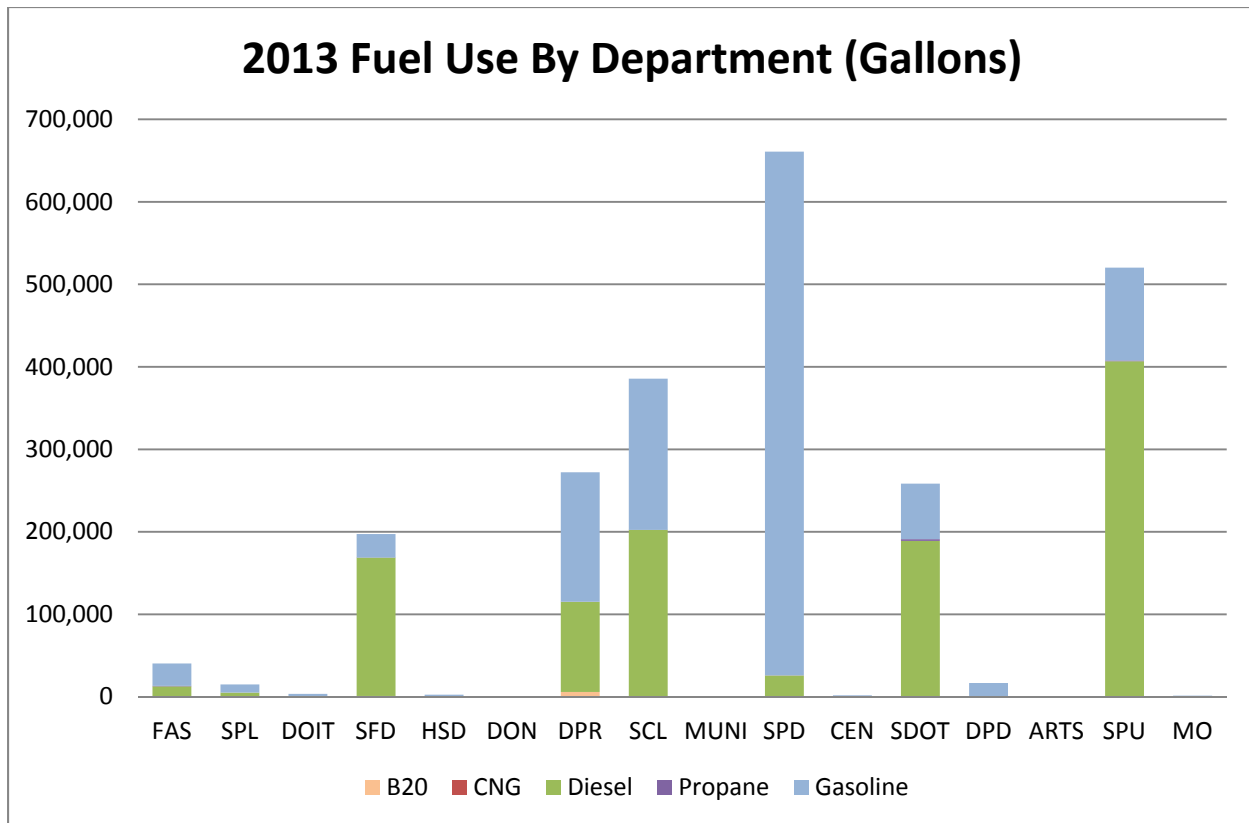
⁵90% CBOB001 + 10% ETHC001

⁶25.62 lbs CO₂/MWh (kWh measured from motor pool Leafs and extrapolated to all Fleet Leafs based on miles driven)

**MIT Unit & Energy Conversions http://mitenergyclub.org/sites/default/files/Units_ConvFactors.MIT_EnergyClub_Factsheet.v8.pdf

***2012 SCL Retail Emissions Factor <http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/#jump3>

Fuel Consumption by Department



Total Vehicle Count & GHG Emissions per Vehicle

Total Equipment Count	
Scooters/Off Road	215
Sedans	751
Vans	515
SUVs	294
Pickups	721
Trucks	552
Construction	219
Horticulture	140
Trailers	436
Misc.	72
TOTAL	3,915

GHG Emissions per Vehicle	
Total GHG (kgCO ₂)	28,513,485
Total Vehicles	3,915
kgCO₂/Vehicle	7,283

Vehicle Miles Traveled (VMT) by Department & GHG Emissions per VMT

Department	2013 VMT
Finance & Administrative Services	734,290
Seattle Public Library	154,236
Dept. of Information Technology	46,455
Seattle Fire Department	1,090,066
Human Services Department	72,648
Dept. of Neighborhoods	5,055
Seattle Parks & Recreation	2,152,296
Seattle City Light	3,079,223
Municipal Court	7,046
Seattle Police Department	5,716,443
Seattle Center	36,408
Seattle Dept. of Transportation	1,571,505
Dept. of Planning & Development	398,130
Arts & Cultural Affairs	5,468
Seattle Public Utilities	3,027,740
Office of Housing	18,836
Mayor's Office	12,487
TOTAL	18,128,332

GHG Emissions per VMT	
Total GHG (kgCO ₂)	28,513,485
Total VMTs	18,128,332
kgCO₂/VMT	1.57

Labor Hours by Department & GHG Emissions per Labor Hour

Department	2013 Labor Hours
Arts & Cultural Affairs	53,443
City Auditor	14,760
City Budget Office	46,944
Seattle Center	590,035
City Employees Retirement System	30,781
Community Police Commission	2,052
Civil Service Commissions	3,987
Dept. of Information Technology	352,202
Dept. of Neighborhoods	110,117
Dept. of Planning & Development	602,553
Seattle Parks & Recreation	1,865,864
Ethics & Elections	10,589
Engineering & Transport (SPU)	21,037
Finance & Administrative Services	930,074
Hearing Examiner	8,262
Human Services Dept.	661,625
Office of Intergovernmental Relations	18,042
Immigrant & Refugee Affairs	7,615
Law Dept.	279,452
Legislative	155,754
Mayor's Office	59,193
Municipal Court	380,229
Office for Civil Rights	42,731
Office of Economic Development	41,197
Office of Housing	66,634
Office of Sustainability & Environment	32,437
Personnel Dept.	143,929
Seattle City Light	3,414,233
Seattle Dept. of Transportation	1,262,199
Seattle Fire Dept.	2,354,013
Seattle Police Dept.	3,461,943
Seattle Public Library	1,019,195
Seattle Public Utilities	2,509,582
TOTAL	20,552,701

GHG Emissions per Labor Hour	
Total GHG (kgCO ₂)	28,513,485
Total Labor Hours	20,552,701
kgCO₂/Labor Hour	1.39